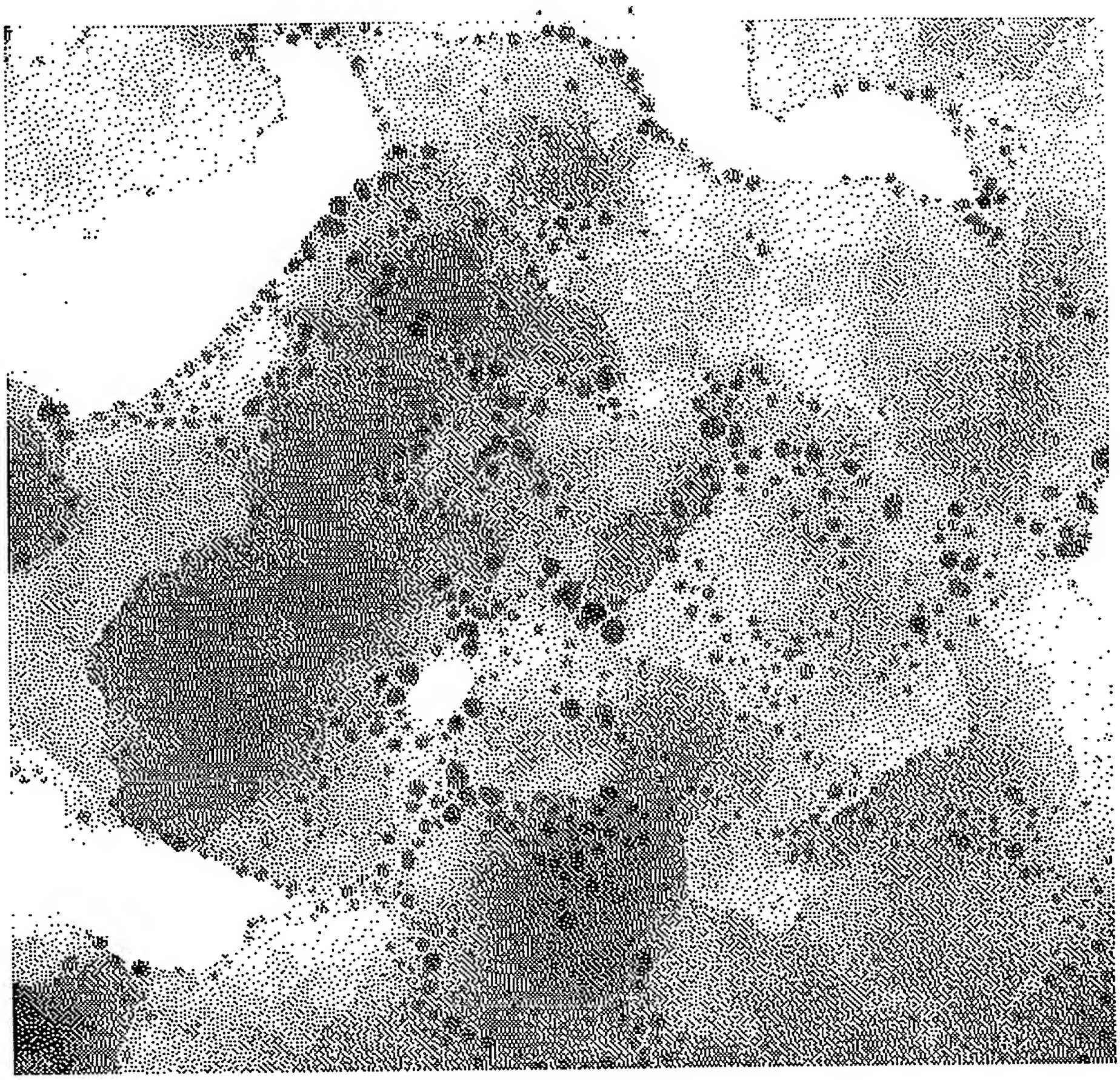

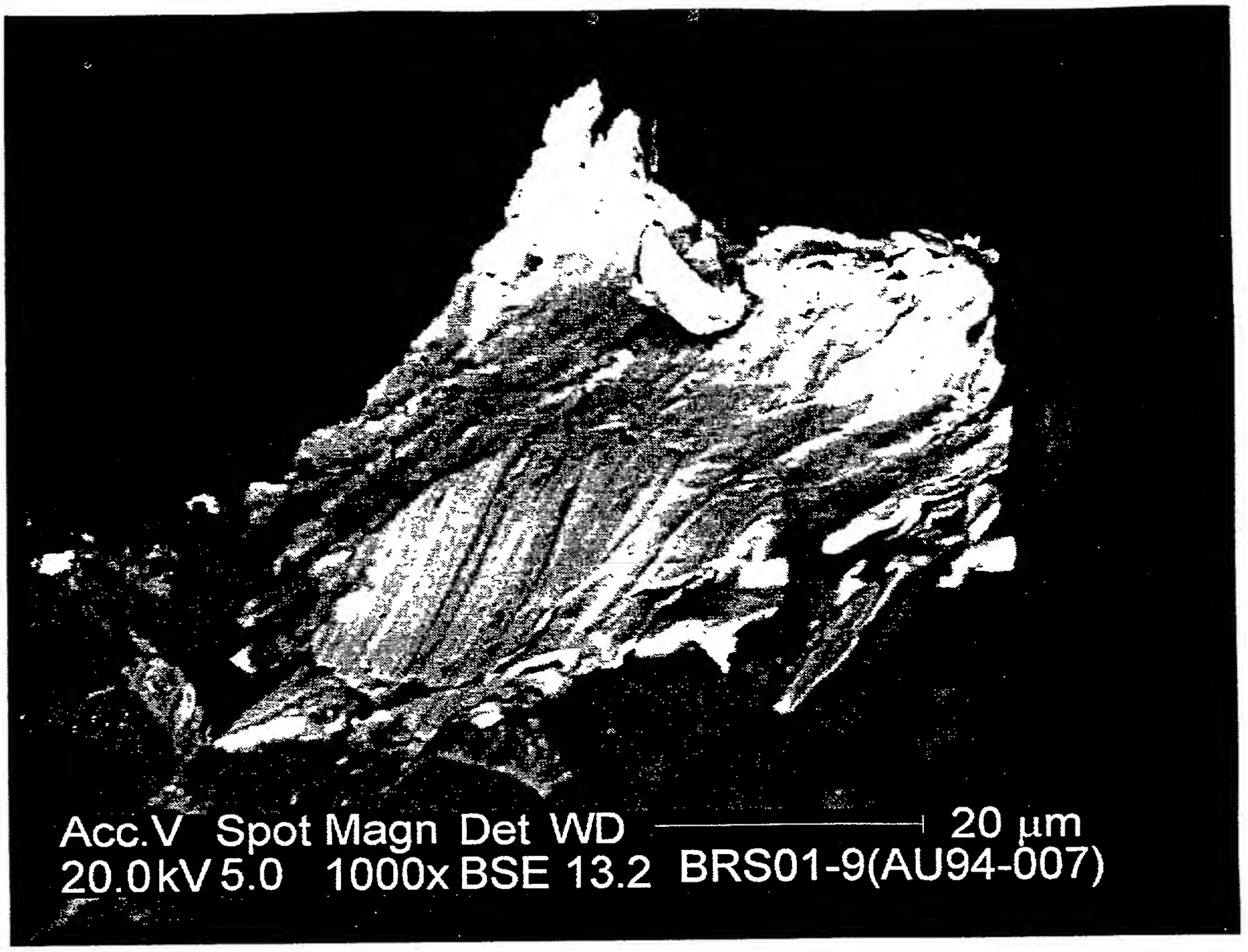
Acc.V Spot Magn Det WD
20.0 kV 5.0 1000x BSE 13.2 BRS01-9(AU94-007)
20 µm

FIGURE 3. A schematic flowsheet of the various aspects of the invention.

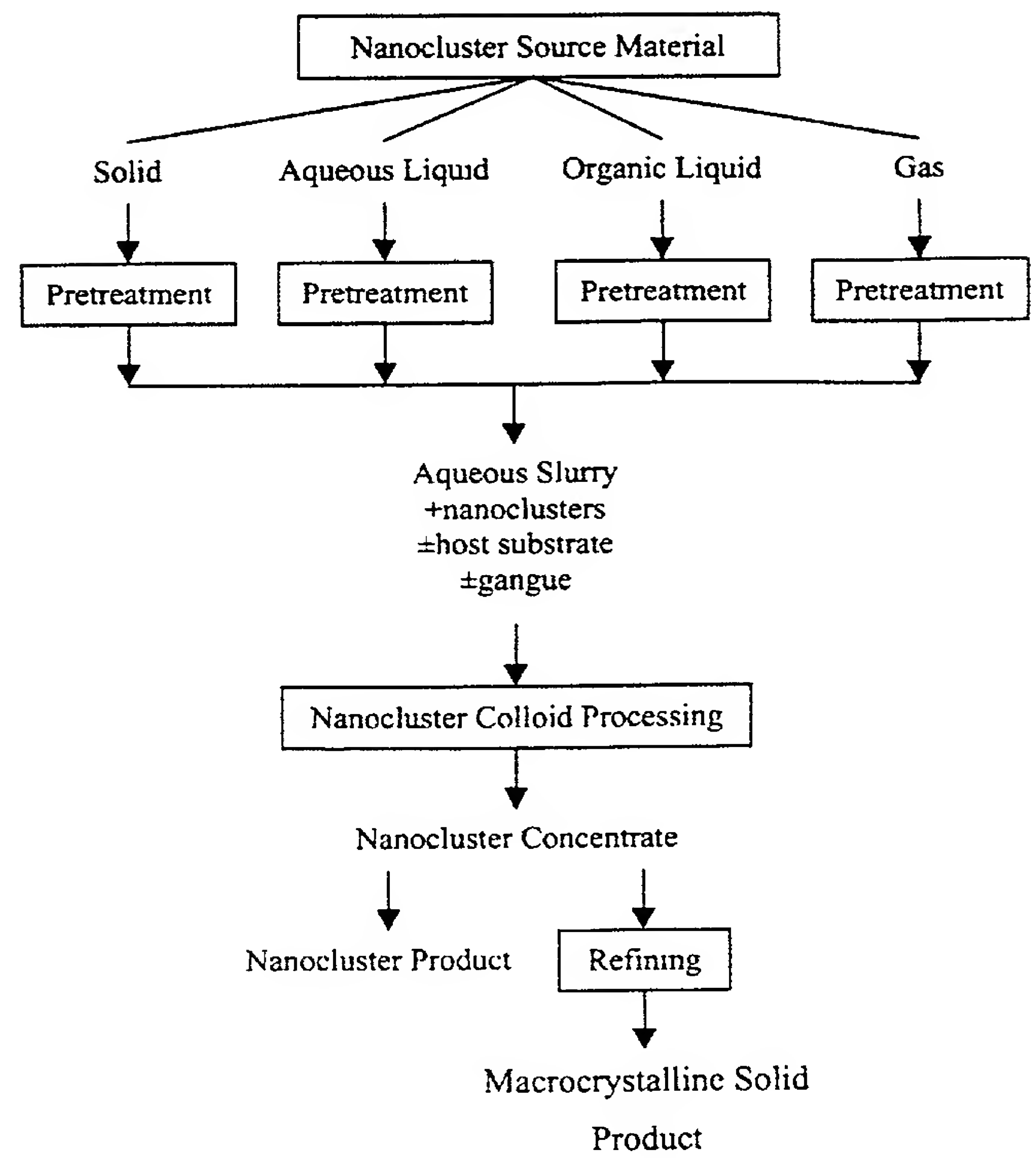

Figure 4. A flow process diagram of pretreatment processes, in accordance with the invention. Explanation: horizontal arrows indicate process; **OP** indicates optional process; underlined indicates material or process product; a downward pointing vertical arrow indicates process products that are advanced to subsequent processing step.

4A. SOLID NANOCLUSTER SOURCE MATERIAL

→ **OP: PREVENT FROM DRYING**

→ **CRUSH**

→ **MILLING**

↓ NANOCLUSTERS + HOST SUBSTRATE + GANGUE ± WATER

→ **SLURRY**

⇒ **TO NANOCLUSTER COLLOID PROCESSING**

4B. AQUEOUS LIQUID NANOCLUSTER SOURCE MATERIAL

→ **OP: PREVENT FROM DRYING**

⇒ **OP: TO NANOCLUSTER COLLOID PROCESSING**

→ **PHASE SEPARATION**

- WATER· to water treatment or recycle

↓ NANOCLUSTERS ± HOST-SUBSTRATE ± GANGUE

→ **SLURRY**

⇒ **TO NANOCLUSTER COLLOID PROCESSING**

Figure 4. Continued.

4C. ORGANIC LIQUID NANOCLUSTER SOURCE MATERIAL

→ **OP: PREVENT FROM DRYING**

→ **PHASE SEPARATION**

- WATER: to aqueous liquid pretreatment, water treatment or recycle

↓ ORGANIC LIQUID + NANOCLUSTERS ± HOST-SUBSTRATE

→ **PHASE SEPARATION**

- ORGANIC LIQUID: to hydrocarbon processing

↓ NANOCLUSTERS ± HOST-SUBSTRATE ± GANGUE

→ **SLURRY**

⇒ **TO NANOCLUSTER COLLOID PROCESSING**

4D. GASEOUS NANOCLUSTER SOURCE MATERIAL

→ **CONDENSOR**

→ **SCRUBBER(S)**

- GAS: to gas processing

↓ WATER + NANOCLUSTERS ± HOST-SUBSTRATE

⇒ **OP: TO NANOCLUSTER COLLOID PROCESSING**

→ **PHASE SEPARATION**

- WATER: to water treatment or recycle

↓ NANOCLUSTERS ± HOST-SUBSTRATE

→ **SLURRY**

⇒ **TO NANOCLUSTER COLLOID PROCESSING**

Figure 5. A flow process diagram for nanocluster colloid processing, in accordance with an embodiment of the invention.

- NANOCLUSTERS ± HOST SUBSTRATE ±GANGUE ± WATER (from pretreatment)
  - → **OP: SLURRY CONDITIONING**
  - → **OP: PHASE SEPARATION**
    - WATER: to water treatment or recycle
    - ↓ ORGANIC LIQUID + NANOCLUSTERS ± HOST-SUBSTRATE
  - → **COLLOID REGENERATION**
  - → **GEL HYDRATION**
  - → **COLLOID PEPTIZATION**
  - → **OP: HEAT & PRESSURE TREATMENT**
  - → **DISPERSION**
  - → **NANOCLUSTER COLLOID DESORPTION**
  - → **PHASE SEPARATION**
    - DEPLETED HOST SUBSTRATE + GANGUE: to recycle or tailings
    - ↓ AQUEOUS NANOCLUSTER COLLOID SOLUTION
  - → **NANOCLUSTER COLLOID RECOVERY**
  - → **PHASE SEPARATION, or**
  - → **ADSORPTION**
    - WATER: to water treatment or recycle
    - ↓ NANOCLUSTER CONCENTRATE
  - → **OP: REFINE**
  - ↓ MACROCRYSTALLINE SOLID PRODUCT

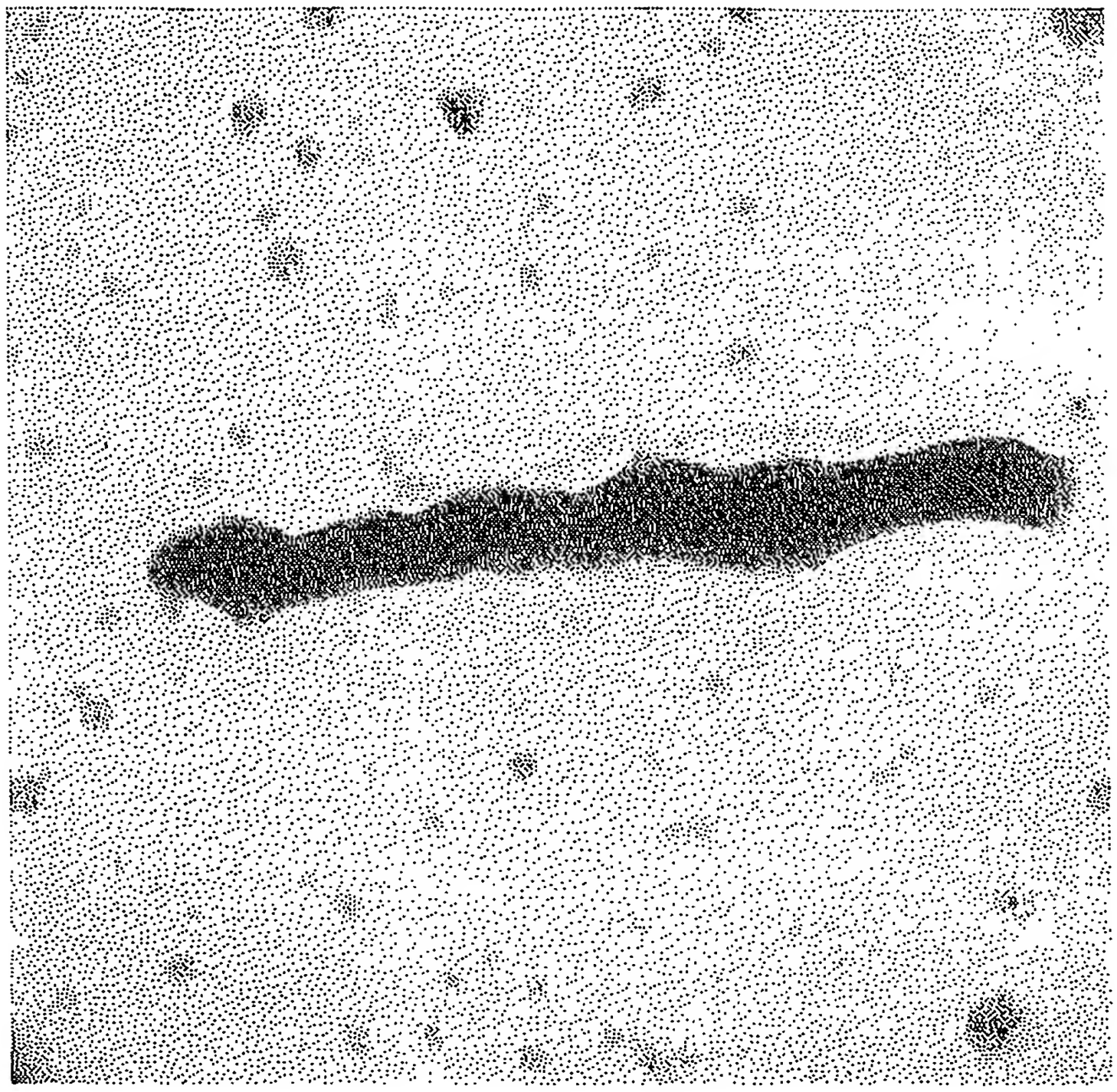

FIGURE 6